

This Page Is Inserted by IFW Operations  
and is not a part of the Official Record

## **BEST AVAILABLE IMAGES**

Defective images within this document are accurate representations of the original documents submitted by the applicant.

Defects in the images may include (but are not limited to):

- BLACK BORDERS
- TEXT CUT OFF AT TOP, BOTTOM OR SIDES
- FADED TEXT
- ILLEGIBLE TEXT
- SKEWED/SLANTED IMAGES
- COLORED PHOTOS
- BLACK OR VERY BLACK AND WHITE DARK PHOTOS
- GRAY SCALE DOCUMENTS

IMAGES ARE BEST AVAILABLE COPY.

**As rescanning documents *will not* correct images,  
please do not report the images to the  
Image Problems Mailbox.**

**THIS PAGE BLANK (USPTO)**

(19)



Europäisches Patentamt

European Patent Office

Office européen des brevets



(11)

**EP 0 938 875 A2**

(12)

**EUROPEAN PATENT APPLICATION**

(43) Date of publication:  
01.09.1999 Bulletin 1999/35

(51) Int. Cl.<sup>6</sup>: **A61C 13/30**

(21) Application number: 99102448.0

(22) Date of filing: 09.02.1999

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE**  
Designated Extension States:  
**AL LT LV MK RO SI**

(30) Priority: 26.02.1998 IT MI980385

(71) Applicants:  
• Martelli, Roberto  
28100 Novara (IT)  
• Massironi, Domenico  
26816 Ossago Lodigiano (Lodi) (IT)

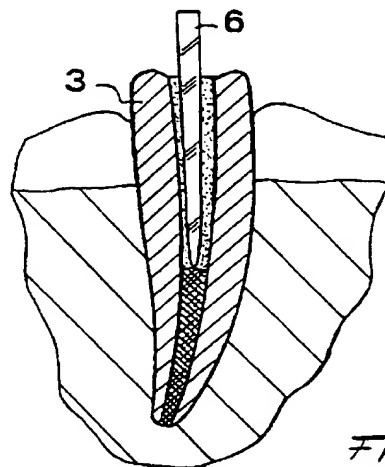
(72) Inventors:  
• Martelli, Roberto  
28100 Novara (IT)  
• Massironi, Domenico  
26816 Ossago Lodigiano (Lodi) (IT)

(74) Representative:  
Ripamonti, Enrico, Dr. Ing. et al  
Ing. A. Giambrocono & C. s.r.l.,  
19/B, Via Rosolino Pilo  
20129 Milano (IT)

(54) **Dental prosthesis support and method for its application**

(57) A dental prosthesis support, comprising at least one pin to be inserted into the root canal of the tooth to be treated, and able to support a core of composite material; said pin is constructed of fibre through which light can pass.

A method for applying the aforesaid dental prosthesis support comprises suitably preparing the root canal, treating this latter using a suitable tool, then washing it; a dentinoenamel adhesive is then applied both inside the canal and onto the support pin, a fluid composite is injected into the root canal in which the pin is then inserted, the fluid composite is polymerized using a light source, and the core is completed by adding fluid composite.



*Fig. 3*

**EP 0 938 875 A2**



## Description

[0001] This invention relates to a dental prosthesis support comprising a pin to be inserted into the root canal of the tooth to be treated.

[0002] The invention also relates to a method for applying said dental prosthesis support.

[0003] To achieve prosthetic recovery of endodontically treated teeth, it is known to use one or more pins each to be inserted into a root canal so that they can act as a support for the overlying tooth reconstruction.

[0004] In particular, for this purpose it is known to use carbon fibre pins to be inserted into the root canal and covered with composite materials, for example self-polymerizing composite cements.

[0005] However, the use of carbon fibre pins for this purpose has various drawbacks.

[0006] Firstly, the use of such pins requires the root canal to be specifically shaped, because the shape of the carbon fibre pin cannot be modified without damaging it irreparably.

[0007] Secondly, such pins do not allow a photopolymerizable composite material to be used inside the canal.

[0008] Moreover, the colour of the carbon fibre pin can sometimes show through and result in very poor appearance.

[0009] The object of this invention is therefore to provide a dental prosthesis support which is extremely practical, of good appearance and functional.

[0010] This object is attained according to the present invention by a dental prosthesis support, comprising at least one pin to be inserted into the root canal of the tooth to be treated, and able to support a core of composite material, characterised in that said pin is constructed of fibre through which light can pass.

[0011] The invention also relates to a method for applying a dental prosthesis support, comprising the following steps: preparing the root canal by filling the endodontium and removing the filling material, treating the root canal using a suitable tipped tool, then washing the canal, characterised by comprising the following further steps: applying a dentinoenamel adhesive both inside the canal and onto said pin, injecting fluid composite directly into the root canal, inserting the pin into the root canal, polymerizing the fluid composite using a light source, and completing the core by successive additions of fluid composite.

[0012] The invention has the following advantages over the state of the art.

[0013] Firstly, a glass fibre pin is easy adaptable to all root canals because its shape can be modified without undergoing damage, and its modulus of elasticity is much closer to that of the dentin compared with a carbon fibre pin.

[0014] Although a glass fibre pin is less rigid than a carbon fibre pin, it has greater mechanical strength.

[0015] This is due firstly to the fact that an exceptional

bond forms between the pin and the composite material because the same chemical compound, namely silicon dioxide, is present in both components.

[0016] Moreover, as the glass fibre of the pin is transparent to light, a fluid photopolymerizable compound can be used to fill the entire space of the root canal, so achieving complete integration of the pin with the core.

[0017] In addition the pin transparency enables the composite material to be polymerized by exposing the composite material to light of suitable wavelength.

[0018] Finally, the transparent pin does not suffer from the poor appearance deriving from the use of carbon fibre pins, and requires less time for its application, besides enabling a core of good appearance to be reconstructed without using prosthetic covering.

[0019] Further advantages and characteristics of the invention will be more apparent from the ensuing description, given by way of non-limiting example with reference to the accompanying drawings, on which:

Figure 1 is a section through the root canal, into which a glass fibre pin of this invention has been inserted;

Figures 2-5 are sections through different stages in the application of the glass fibre pin;

Figure 6 is a side view of the glass fibre pin of the invention;

Figure 7 is a section through an alternative embodiment of this invention, in which a plurality of small-dimension pins are inserted into the same root canal;

Figure 8 is a section through the root of a tooth provided with two root canals, each housing a glass fibre pin of the invention; and

Figure 9 is a section through a further embodiment of the invention, in which a plurality of small-dimension pins and one standard-dimension pin are inserted into the same root canal.

[0020] In the ensuing description reference will be made to some preferred embodiments of the invention, representing non-limiting examples of possible variants.

[0021] Figure 1 shows a section through the root canal 2 pertaining to a root 3 of a tooth to be treated, and in which a pin 6 is inserted; the bone 5 and the jaw 4 which surround the root 3 are also visible in section.

[0022] The pin 6 is used to support a core 10 of composite material.

[0023] The pin 6 is constructed of resin-reinforced glass fibre, to allow light to pass through.

[0024] It is important to note that to achieve the best mechanical properties for the prosthesis obtained with the pin of the invention, the pin 6 and the composite material 10 have at least one chemical compound in common, namely silicon dioxide.

[0025] Figure 7 shows a section through an alternative embodiment of the invention, in which a plurality of pins 14, 15, 16, all of small dimensions, are inserted in the

same root canal 3.

[0026] Figure 8 shows a section through the root of a tooth 17, for example a molar tooth, provided with two root canals 22 and 23, each housing a pin 6.

[0027] Figure 9 shows a section through a further embodiment of the invention, in which a plurality of small-dimension pins 14, 15 and one standard-dimension pin 6 are inserted in the same root canal 3.

[0028] The pin 6 tapers slightly and has a rounded point 12. Alternatively the pin 6 can have a first portion with a certain taper, and a second portion with a different taper, terminating with a rounded point.

[0029] These shapes for the pin 6 are indicated as non-limiting examples of the possible shapes for the glass fibre pin of this invention.

[0030] The invention also relates to a method for applying the dental prosthesis support comprising the glass fibre pin.

[0031] The method of the invention comprises firstly preparing the root canal 2 by filling the endodontium in known manner.

[0032] The filling material is then removed, preferably using manual instruments to prevent stepping or perforations forming within the canal 2.

[0033] The canal 2 is then washed and worked with a suitable tipped tool, in particular a coarse diamond cutter, the purpose of which is solely to roughen the canal walls 8 as shown in Figure 2, but not to adapt it to the shape of the glass fibre pin 6.

[0034] At this point the pin 6 is tested to see how well it adapts to the canal 2, as a result of which the pin 6 can if necessary be modified to adapt it to the shape and dimensions of the canal 2.

[0035] This adaptation is achieved using a suitable tool and leaving a portion of the pin projecting beyond the occlusal entrance of the canal 2, to facilitate transmission of the photopolymerizing light at the appropriate time.

[0036] The surface of the glass fibre pin 6 is then treated with a suitable substance, such as hydrofluoric acid, and the dentin of the root canal 2 is treated with orthophosphoric acid.

[0037] After carefully washing the pin and the root canal, a dentin/enamel adhesive is applied both inside the canal 2 and onto the pin 6.

[0038] The adhesive can now be made to undergo initial photopolymerization by exposing the pin 6 to a light source of suitable wavelength.

[0039] At this point the fluid composite is directly injected into the root canal 2 until full.

[0040] The pin 6 is then inserted into the root canal 2 and the fluid composite polymerized using light of suitable wavelength, this being aimed directly onto the top of the pin as shown by the light source 9 in Figure 4.

[0041] Finally the core 10 is completed by successive additions of fluid composite.

[0042] Figure 5 shows the composite material core 10 at the end of treatment, provided with a prosthesis 16.

[0043] From the foregoing description it is apparent that the invention attains its desired objects.

## Claims

1. A dental prosthesis support, comprising at least one pin to be inserted into the root canal of the tooth to be treated, and able to support a core of composite material, characterised in that said pin is constructed of fibre through which light can pass.
2. A dental prosthesis support as claimed in claim 1, characterised by comprising a plurality of said fibre pins engaged in the same canal.
3. A dental prosthesis support as claimed in claim 2, characterised in that at least one of said fibre pins engaged in the same canal is of different dimensions from the others.
4. A dental prosthesis support as claimed in claim 1 or 2, characterised by comprising two fibre pins each engaged in a different root canal within the same root.
5. A dental prosthesis support as claimed in one or more of the preceding claims, characterised in that said pin is constructed of resin-reinforced glass fibre.
6. A dental prosthesis support as claimed in one or more of the preceding claims, characterised in that said pins and said composite material have at least one chemical compound in common.
7. A dental prosthesis support as claimed in claim 6, characterised in that said chemical compound common to the pin and to the composite material is silicon dioxide.
8. A dental prosthesis support as claimed in one or more of the preceding claims, characterised in that said pin is of slightly tapering shape and has a rounded point.
9. A dental prosthesis support as claimed in one or more of the preceding claims, characterised in that said pin is of cylindrical-conical or conical shape with a non-rounded point.
10. A method for applying a dental prosthesis support in accordance with the preceding claims, comprising the following steps: preparing the root canal by filling the endodontium and removing the filling material, treating the root canal using a suitable tipped tool, then washing the canal, characterised by comprising the following further steps: applying a dentin/enamel adhesive both inside the canal

and onto said pin, injecting fluid composite directly into the root canal, inserting the pin into the root canal, polymerizing the fluid composite using a light source, and completing the core by successive additions of fluid composite.

5

11. A method for applying a dental prosthesis support as claimed in claim 10, characterised in that said polymerization of the composite material is achieved by aiming light directly onto the top of the pin for a short period of time.
12. A method for applying a dental prosthesis support as claimed in claim 10 or 11, characterised by comprising the further step of adapting the shape of said pin to the shape of the root canal for which it is intended.

10

15

20

25

30

35

40

45

50

55

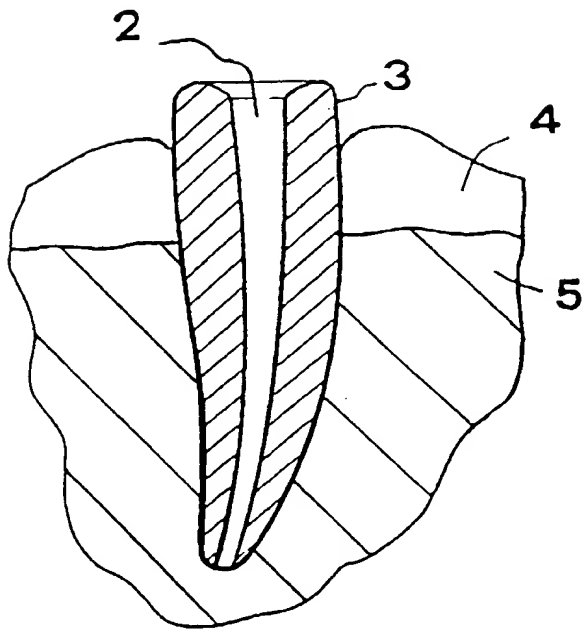


Fig. 1

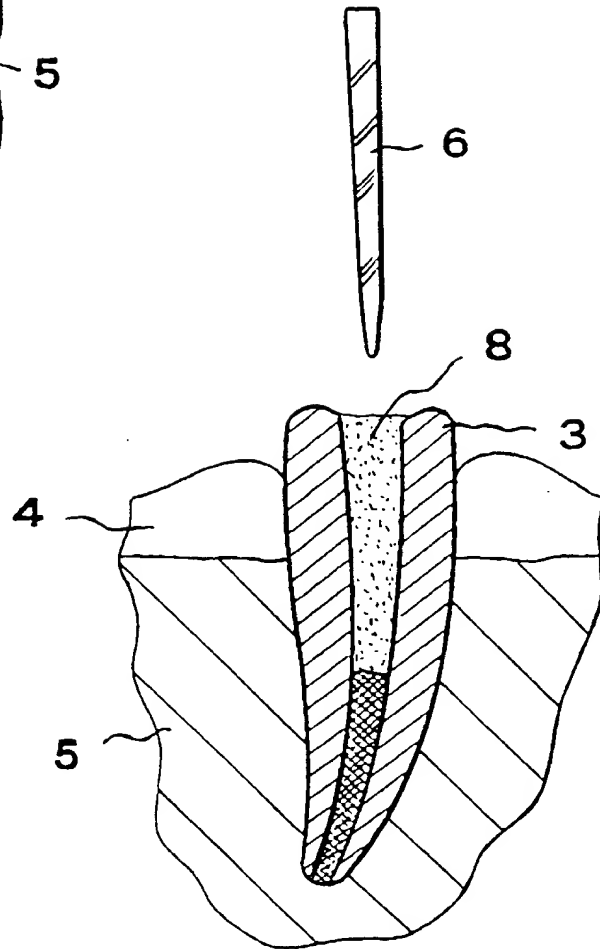


Fig. 2

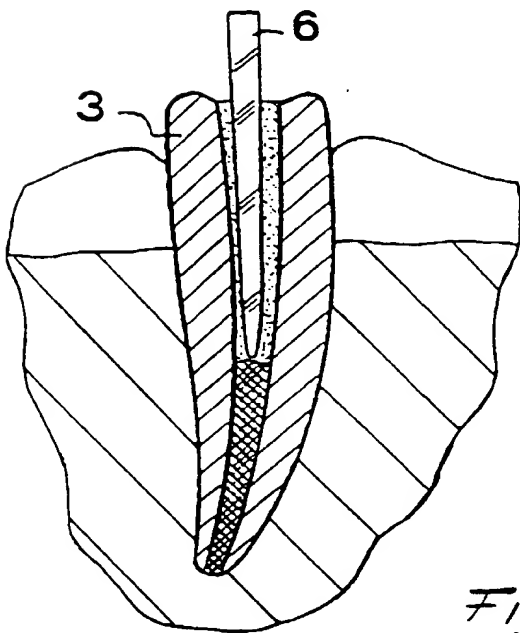
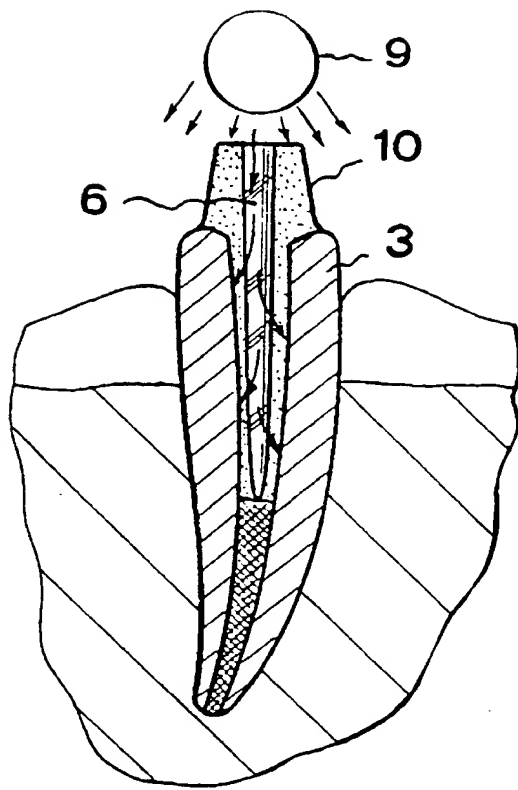
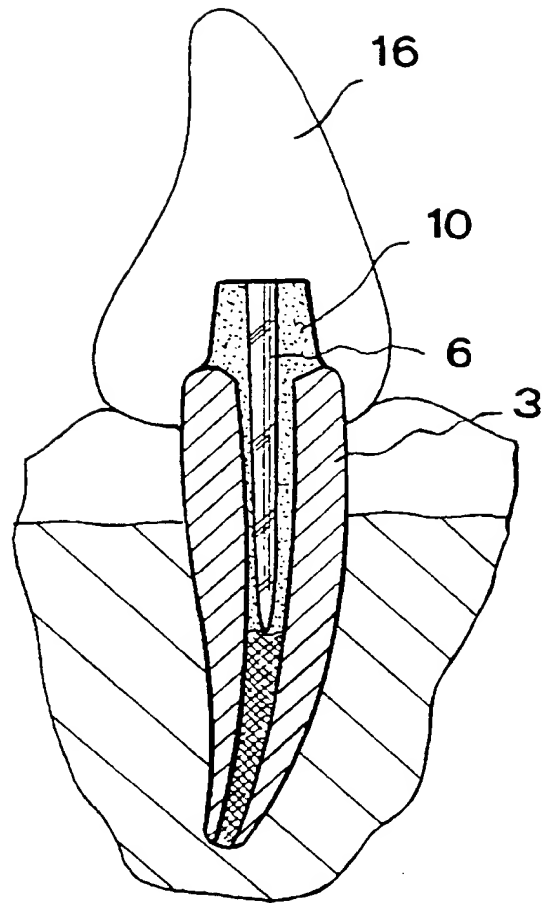


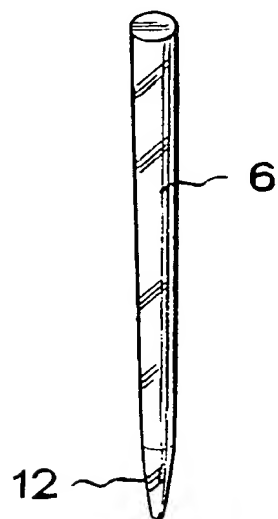
Fig. 3



*Fig. 4*

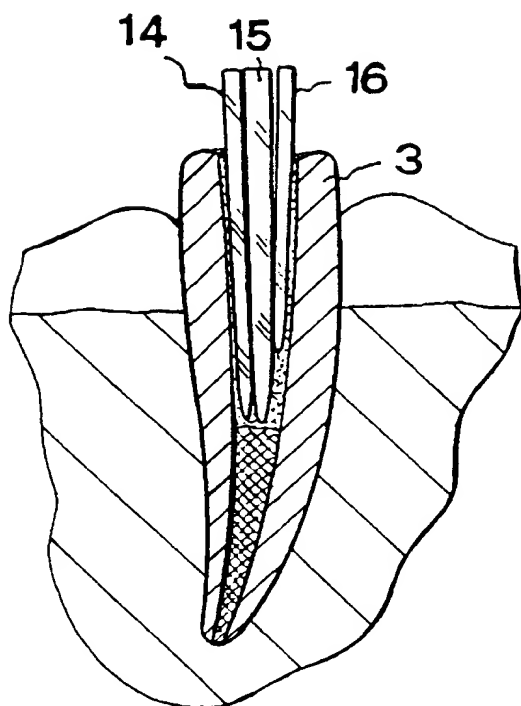


*Fig. 5*

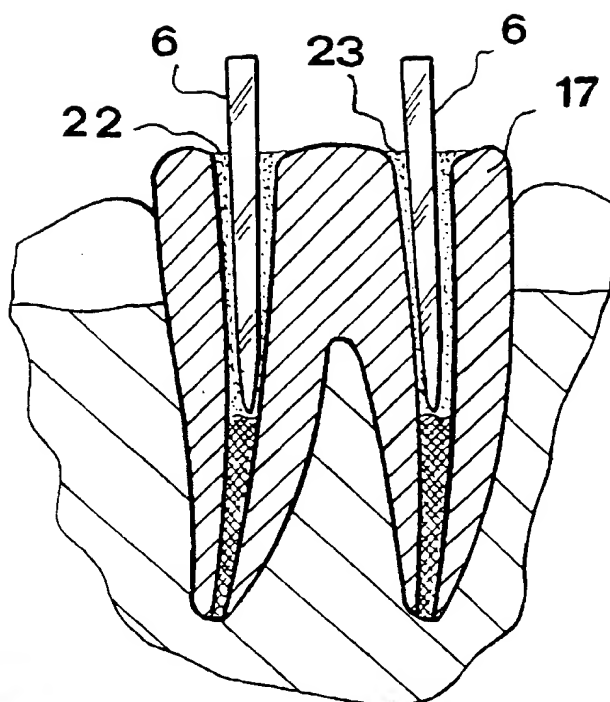


*Fig. 6*

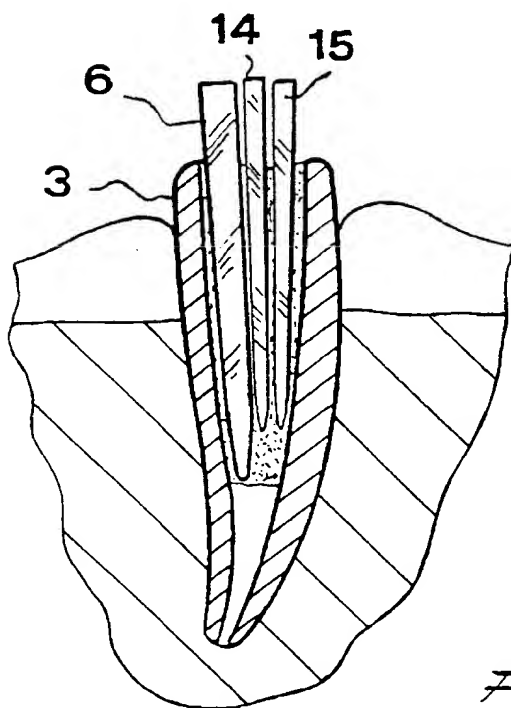




*Fig. 7*



*Fig. 8*



*Fig. 9*

**THIS PAGE BLANK (USPTO)**

(19)



Europäisches Patentamt  
European Patent Office  
Office européen des brevets



(11)

**EP 0 938 875 A3**

(12)

**EUROPEAN PATENT APPLICATION**

(88) Date of publication A3:  
17.05.2000 Bulletin 2000/20

(51) Int. Cl.<sup>7</sup>: **A61C 13/30**

(43) Date of publication A2:  
01.09.1999 Bulletin 1999/35

(21) Application number: **99102448.0**

(22) Date of filing: **09.02.1999**

(84) Designated Contracting States:  
**AT BE CH CY DE DK ES FI FR GB GR IE IT LI LU  
MC NL PT SE**  
Designated Extension States:  
**AL LT LV MK RO SI**

(72) Inventors:  
• **Martelli, Roberto**  
28100 Novara (IT)  
• **Massironi, Domenico**  
26816 Ossago Lodigiano (Lodi) (IT)

(30) Priority: 26.02.1998 IT MI980385

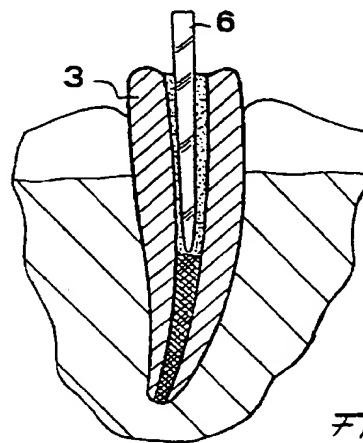
(71) Applicants:  
• **Martelli, Roberto**  
28100 Novara (IT)  
• **Massironi, Domenico**  
26816 Ossago Lodigiano (Lodi) (IT)

(74) Representative:  
**Ripamonti, Enrico, Dr. Ing. et al**  
**Ing. A. Giambrocono & C. s.r.l.,**  
19/B, Via Rosolino Pilo  
20129 Milano (IT)

**(54) Dental prosthesis support and method for its application**

(57) A dental prosthesis support, comprising at least one pin to be inserted into the root canal of the tooth to be treated, and able to support a core of composite material; said pin is constructed of fibre through which light can pass.

A method for applying the aforesaid dental prosthesis support comprises suitably preparing the root canal, treating this latter using a suitable tool, then washing it; a dentinoenamel adhesive is then applied both inside the canal and onto the support pin, a fluid composite is injected into the root canal in which the pin is then inserted, the fluid composite is polymerized using a light source, and the core is completed by adding fluid composite.



*Fig. 3*

**EP 0 938 875 A3**



European Patent  
Office

# PARTIAL EUROPEAN SEARCH REPORT

Application Number

which under Rule 45 of the European Patent Convention EP 99 10 2448 shall be considered, for the purposes of subsequent proceedings, as the European search report

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
X	WO 96 25119 A (CHU MANH ;REYNAUD MARC (FR); REYNAUD PIERRE LUC (FR)) 22 August 1996 (1996-08-22) * page 1, line 3 - line 6 *	1,4-7,9	A61C13/30
Y	* page 3, line 7 - line 18 * * page 6, line 10 - line 15 * * page 7, line 4 - line 8 * * page 7, line 14 - line 17 * * figures 1,3 *	2,3	
Y	--- US 4 820 159 A (WEISSMAN BERNARD) 11 April 1989 (1989-04-11) * column 2, line 54 - line 59 * * column 8, line 34 - line 41 * * figures 22,23 *	2,3	
X	--- DE 39 01 640 A (COMPODENT RESEARCH AND APPLIC) 10 August 1989 (1989-08-10) * column 1, line 57 - line 62 * * column 2, line 7 - line 15 * * column 3, line 35 - line 37 * * figure 2 *	1,4,5,8,9	
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)
			A61C
<b>INCOMPLETE SEARCH</b> <p>The Search Division considers that the present application, or one or more of its claims, does/do not comply with the EPC to such an extent that a meaningful search into the state of the art cannot be carried out, or can only be carried out partially, for these claims.</p> <p>Claims searched completely : 1-9</p> <p>Claims searched incompletely : 10-12</p> <p>Reason for the limitation of the search: Article 52 (4) EPC - Method for treatment of the human or animal body by surgery</p>			
Place of search <b>THE HAGUE</b>		Date of completion of the search <b>21 March 2000</b>	Examiner <b>Salvignol, A</b>
<b>CATEGORY OF CITED DOCUMENTS</b> X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document			

EPO FORM 1503 03.82 (P04C07)



European Patent  
Office

## PARTIAL EUROPEAN SEARCH REPORT

Application Number  
EP 99 10 2448

DOCUMENTS CONSIDERED TO BE RELEVANT			CLASSIFICATION OF THE APPLICATION (Int.Cl.6)
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	
A	US 5 145 373 A (ROANE JAMES B) 8 September 1992 (1992-09-08) * column 1, line 26 - line 34 * * column 5, line 26 - line 37; figure 4 * * figure 11 *	4,8	
	---		
E	US 5 964 592 A (HITES ANDRAS A (US); HITES GEORGE (US); PESCATORE CHRIS (US)) 12 October 1999 (1999-10-12) * column 3, line 40 - line 43 * * column 3, line 63 - column 4, line 2 * * column 4, line 21 - line 26 * * column 4, line 35 - line 39 * * claim 1; figure 4 *	1,4-9	
	-----		
			TECHNICAL FIELDS SEARCHED (Int.Cl.6)

EPO FORM 1500 03.82 (P04C19)

**ANNEX TO THE EUROPEAN SEARCH REPORT  
ON EUROPEAN PATENT APPLICATION NO.**

EP 99 10 2448

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on  
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

21-03-2000

Patent document cited in search report	Publication date	Patent family member(s)	Publication date
WO 9625119 A	22-08-1996	FR 2730627 A CA 2212953 A DE 69606167 D EP 0809475 A JP 11505439 T US 5989032 A	23-08-1996 22-08-1996 17-02-2000 03-12-1997 21-05-1999 23-11-1999
US 4820159 A	11-04-1989	AU 2125788 A CA 1297323 A WO 8900837 A	01-03-1989 17-03-1992 09-02-1989
DE 3901640 A	10-08-1989	FR 2626167 A GB 2214087 A	28-07-1989 31-08-1989
US 5145373 A	08-09-1992	US 5035620 A	30-07-1991
US 5964592 A	12-10-1999	NONE	

EPO FORM P0459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82